Introduction

Bourns® Sensors Controls Product Line has continued to expand its encoder product offering with a wide variety of models to support our customers’ specific applications. Recognized worldwide for supplying standard and custom solutions as well as providing excellent technical support, Sensors and Controls is committed to providing our customers with reliable rotary encoder solutions.

General Design Consideration

Encoders are the digital version of potentiometers and panel controls. Rather than providing a resistive variable output with rotation of the shaft, encoders simulate an on/off switching digital output. Applied as human-to-machine interface (HMI) devices, encoders are typically used to sense human adjustment of the device in a clockwise or counter-clockwise direction triggering some action by the digital circuit. Applied as machine-to-machine interface (MMI) devices, encoders are typically coupled to a motor or other mechanical device to sense speed and direction of rotation.

Important Characteristics

In selecting an encoder for your application, the most important characteristics to consider are the type of technology, type of output signal, speed of rotation, expected cycle life and switching capability of the product and whether an incremental or absolute encoder is needed.

There are two basic technology classifications of encoders: contacting (mechanical) and non-contacting (optical and magnetic). Your application will dictate the type of technology that will be best suited for your design.

Custom Solutions

A wide range of “value-added” enhancements are available to provide our customers with cost-effective solutions. Bourns’ capability to develop custom encoder solutions and modifications includes the following:

- Cable harness/lead wires
- Detents
- Custom output
- Seal
- Torque
- Special packaging
- Terminal configurations
- Hardware
- Marking
- Mechanical stops
- Mounting brackets
- Special test requirements
- Customized shaft options

For additional information on value-added enhancements, please contact your local Bourns Sales Representative.
Flowchart for assistance in selecting the appropriate encoder model for your application.
## Bourns® Encoders

<table>
<thead>
<tr>
<th>Model</th>
<th>Rotational Life</th>
<th>Types of Output</th>
<th>Resolution Options (PPR)</th>
<th>Operating Temp. Range</th>
<th>Contact Rating</th>
<th>Detent Option</th>
<th>Technology</th>
<th>Features</th>
</tr>
</thead>
</table>
| EAW   | 25,000 Cycles Min. | Absolute, Quadrature | 128, 6, 9, 12, 24, 36 | -40 °C to +85 °C | 10 mA @ 10 VDC | No Contacting | - Absolute encoder / absolute code output  
- Digital output  
- Sturdy construction  
- Bushing mount  
- Available with PC board mounting bracket  
- RoHS compliant version available* |
| ECW   | 100,000 Cycles Min. | Quadrature | 6, 9, 12, 24, 36 | -40 °C to +85 °C | 10 mA @ 10 VDC | Yes Contacting | - Exceptionally long operating life  
- Sturdy construction  
- Bushing mount  
- Available with PC board mounting bracket  
- RoHS compliant version available*  
- Recommended for HMI applications |
| EPS   | 100,000 Cycles Min. | Quadrature | 6, 9, 12, 24, 36 | +1 °C to +85 °C | 10 mA @ 10 VDC | Yes Contacting | - Incremental encoder  
- Momentary push switch option  
- Sturdy construction  
- Snap-in mount  
- Long operating life |
| ES    | 100,000 Cycles Min. | Quadrature | 6, 9, 12, 24 | -40 °C to +85 °C | 10 mA @ 10 VDC | Yes Contacting | - Snap-in shaft flexibility - top or bottom  
- Snap-in PC board mount  
- Long operating life  
- Up to 24 full quadrature outputs per revolution  
- RoHS compliant version available*  
- Recommended for HMI applications |
| PAC18R| 30,000 Cycles Min. | Absolute | 8, 12 & 16 Positions | -35°C to +70°C | 1 mA @ 10 VDC | Yes Contacting | - Low Profile Absolute Encoder  
- High-class rotational feel  
- Haptic Detent Feedback  
- Sealed Shaft  
- Insulated Plastic Shaft and Bushing  
- RoHS compliant* |
| PEC09 | 30,000 Cycles Min. | Quadrature | 19 | -10 °C to +65 °C | 1 mA @ 5 VDC | Yes Contacting | - Compact design  
- Long life and high reliability  
- Shaftless  
- Detent option  
- RoHS compliant*  
- Recommended for HMI applications |
| PEC11D| 30,000 shaft revolutions | Quadrature | 12, 18, 24 | -30 °C to +70 °C | 1 mA @ 5 VDC | Yes Contacting | - High reliability  
- RoHS compliant*  
- Momentary push switch option  
- Compact, rugged design  
- Metal bushing/shaft  
- Recommended for HMI applications |
| PEC11H| 100,000 Cycles Min. | Quadrature | 8, 15, 16, 20 and 24 | -20 °C to +70 °C | 10 mA @ 5 VDC | Yes Contacting | - Push switch option  
- High detent torque  
- High rotational life and switch life  
- Metal bushing/shaft  
- RoHS compliant* |

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<tr>
<th>Model</th>
<th>Type</th>
<th>Life</th>
<th>Output Options (PPR)</th>
<th>Temp. Range</th>
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<th>Detent Option</th>
<th>Technology Features</th>
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<td>PEC11J</td>
<td>Rotational</td>
<td>100,000 Cycles Min.</td>
<td>Quadrature 9, 15</td>
<td>-10 °C to +70 °C</td>
<td>10 mA @ 5 VDC</td>
<td>Yes</td>
<td>Contacting - Push switch option standard - Compact, rugged design - High reliability - Metal bushing/shaft - Surface mount - Long rotational life - RoHS compliant*</td>
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<td>PEC11L</td>
<td>Rotational</td>
<td>100,000 Cycles Min.</td>
<td>Quadrature 9, 15, 20</td>
<td>-30 °C to +70 °C</td>
<td>1 mA @ 5 VDC</td>
<td>Yes</td>
<td>Contacting - High reliability - RoHS compliant* - Momentary push switch option - Compact, rugged design - Metal bushing/shaft</td>
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<td>PEC11R</td>
<td>Rotational</td>
<td>30,000 Cycles Min.</td>
<td>Quadrature 12, 18, 19, 24</td>
<td>-30 °C to +70 °C</td>
<td>10 mA @ 5 VDC</td>
<td>Yes</td>
<td>Contacting - Push switch option - Compact, rugged design - High reliability - Metal bushing/shaft</td>
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<td>PEC11S</td>
<td>Rotational</td>
<td>30,000 Cycles Min.</td>
<td>Quadrature 15</td>
<td>-10 °C to +65 °C</td>
<td>1 mA @ 5 VDC</td>
<td>Yes</td>
<td>Contacting - Compact design - Long life and high reliability - Shaftless - Detent option - RoHS compliant* - Recommended for HMI applications</td>
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<tr>
<td>PEC12R</td>
<td>Rotational</td>
<td>15,000 Cycles Min.</td>
<td>Quadrature 12, 24</td>
<td>-30 °C to +70 °C</td>
<td>1 mA @ 5 VDC</td>
<td>Yes</td>
<td>Contacting - Compact design - RoHS compliant* - Long life and high reliability - Momentary push switch option - Rear and side mount versions - Recommended for HMI applications</td>
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<td>PEC16</td>
<td>Rotational</td>
<td>50,000 Cycles Min.</td>
<td>Quadrature 12, 24</td>
<td>-30 °C to +70 °C</td>
<td>1 mA @ 5 VDC</td>
<td>Yes</td>
<td>Contacting - Compact design - RoHS compliant* - Long life and high reliability - Momentary push switch option - Rear and side mount versions - Recommended for HMI applications</td>
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<td>PEL12</td>
<td>Rotational</td>
<td>30,000 Cycles Min.</td>
<td>Quadrature 24</td>
<td>-10 °C to +65 °C</td>
<td>1 mA @ 5 VDC</td>
<td>Yes</td>
<td>Contacting - Compact design - Long life and high reliability - Shaftless - Detent option - RoHS compliant* - Recommended for HMI applications</td>
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<td>PES12</td>
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<td>30,000 Cycles Min.</td>
<td>Quadrature 24</td>
<td>-10 °C to +65 °C</td>
<td>1 mA @ 5 VDC</td>
<td>Yes</td>
<td>Contacting - Compact design - Long life and high reliability - Shaftless - Detent option - RoHS compliant* - Recommended for HMI applications</td>
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<tr>
<td>PER28</td>
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<td>Technology</td>
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<tr>
<td></td>
<td>50,000 Cycles Min.</td>
<td>Quadrature</td>
<td>10</td>
<td>-10 °C to +60 °C</td>
<td>10 mA @ 5 VDC</td>
<td>Yes</td>
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<th>EM14</th>
<th>Rotational Life</th>
<th>Types of Output</th>
<th>Resolution Options (PPR)</th>
<th>Operating Temp. Range</th>
<th>Contact Rating</th>
<th>Detent Option</th>
<th>Technology</th>
<th>Features</th>
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</thead>
<tbody>
<tr>
<td>Non-detent: 1,000,000 cycles With detents: 100,000 cycles</td>
<td>Quadrature</td>
<td>8, 16, 32, 64</td>
<td>-40 °C to +70 °C</td>
<td>TTL, CMOS, HCMOS</td>
<td>Yes</td>
<td>Optical</td>
<td>- Compact package size - Bracket option - High rotational cycle life - RoHS compliant* - Standard and high force push switch option - Splash proof shaft seal - Recommended for HMI applications - Cable &amp; connector option - Sealed to IP 54</td>
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<tr>
<th>EN</th>
<th>Rotational Life</th>
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<th>Resolution Options (PPR)</th>
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<th>Detent Option</th>
<th>Technology</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000,000 cycles / With ball bearing: 100,000,000 cycles</td>
<td>Quadrature</td>
<td>25, 50, 64, 100, 125, 128, 200, 256</td>
<td>-40 °C to +85 °C</td>
<td>TTL, CMOS, HCMOS</td>
<td>No</td>
<td>Optical</td>
<td>- Bushing or servo mount - Index channel available - High rotational cycle life - High operating speed - RoHS compliant version available* - Recommended for HMI and MMI applications</td>
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</tr>
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</table>

<table>
<thead>
<tr>
<th>EMS22</th>
<th>Rotational Life</th>
<th>Types of Output</th>
<th>Resolution Options (PPR)</th>
<th>Operating Temp. Range</th>
<th>Contact Rating</th>
<th>Detent Option</th>
<th>Technology</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>50,000,000 cycles</td>
<td>Quadrature, Absolute and PWM</td>
<td>32, 64, 128, 256, 512/1024</td>
<td>-40 °C to +125 °C</td>
<td>TTL, CMOS</td>
<td>No</td>
<td>Magnetic</td>
<td>- Extremely long life - RoHS compliant* - High operating speed - Bushing or servo mount - 3.3 and 5 VDC voltage supply options - 1 or 3 index channels (quadrature output only) - Sealed to IP 65 with option of IP 67 - Recommended for HMI &amp; MMI applications</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ES14</th>
<th>Rotational Life</th>
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</tr>
</thead>
<tbody>
<tr>
<td>50,000,000 Cycles Min.</td>
<td>Quadrature</td>
<td>8, 16, 32, 64</td>
<td>-40 °C to +70 °C</td>
<td>HCMOS, CMOS and TTL</td>
<td>No</td>
<td>Contacting</td>
<td>- HCMOS, CMOS and TTL compatible - Compact package size - High rotational cycle life - Ball bearing shaft support - RoHS compliant* - Recommended for HMI and MMI applications</td>
<td></td>
</tr>
</tbody>
</table>

Bourns® Encoder Applications

Professional and Consumer Audio Applications
- Studio recording equipment
- Digital mixing consoles
- Digital broadcast equipment
- Professional sound systems
- Digital amplifiers
- Digital car audio

Industrial/Factory Automation Applications
- Robotics
- Material handling
- Forklift trucks
- Machine tools
- Automated gates/doors
- Fluid measurement

Medical Product Applications**
- Blood / chemical analyzers
- Centrifuge equipment
- Blood monitors
- Computer Assisted Tomography (CAT) equipment
- Electrosurgical equipment
- Dialysis equipment
- Incubators
- Lasers
- Magnetic Resonance Imaging (MRI) equipment
- Medical meters
- EKG, EEG, heart monitors
- Temperature and respiratory monitors
- Insulin and infusion pumps
- Radiographic equipment
- Strip charts

Test and Measurement Product Applications
- Oscilloscopes
- Logical and spectrum analyzers
- Signal level testers
- Weather instruments
- Digital monitors
- Board in-circuit testers
- Calibration equipment
- Counters
- Timers
- Cycle testers
- Distortion testers
- Electrostatic testers
- Environmental chambers and testers

Portable Electronics Product Applications
- Data communication testers
- Appliances
- Intercom systems
- Irrigation controllers
- Measuring equipment
- Power generators, radio systems
- Portable monitoring equipment
- Portable test equipment
- Portable weather stations and systems
- Scanners
- Copiers
- Multimeters

Note:
** Bourns® products have not been designed for and are not intended for use in "lifesaving," "life-critical" or "life-sustaining" applications nor any other applications where failure or malfunction of the Bourns® product may result in personal injury or death. See Legal Disclaimer at: www.bourns/docs/legal/disclaimer.pdf
# Worldwide Sales Offices

<table>
<thead>
<tr>
<th>Country</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Americas</td>
<td>+1-951-781-5500</td>
<td><a href="mailto:americus@bourns.com">americus@bourns.com</a></td>
</tr>
<tr>
<td>Brazil</td>
<td>+55 11 5505 0601</td>
<td><a href="mailto:americus@bourns.com">americus@bourns.com</a></td>
</tr>
<tr>
<td>China</td>
<td>+86 21 64821250</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
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<tr>
<td>Europe, Middle East, Africa</td>
<td>+36 88 885 877</td>
<td><a href="mailto:eurocus@bourns.com">eurocus@bourns.com</a></td>
</tr>
<tr>
<td>Japan</td>
<td>+81 49 269 3204</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
</tr>
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<td>Korea</td>
<td>+82 70 4036 7730</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
</tr>
<tr>
<td>Singapore</td>
<td>+65 6348 7227</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
</tr>
<tr>
<td>Taiwan</td>
<td>+886 2 25624117</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
</tr>
<tr>
<td>Other Asia-Pacific Countries</td>
<td>+886 2 25624117</td>
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Bourns® products are available through an extensive network of manufacturer’s representatives, agents and distributors. To obtain technical applications assistance, a quotation, or to place an order, contact a Bourns representative in your area.

Specifications subject to change without notice. Actual performance in specific customer applications may differ due to the influence of other variables. Customers should verify actual device performance in their specific applications.

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